Flexible Matchmaking of Web Services Using DAML-S Ontologies

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ABSTRACT

Service discovery is one of the major challenges in the emerging area of Service Oriented Computing (SOC), which promotes the notion of service as the basic brick for the development of next generation distributed heterogeneous software systems. State-of-the-art matchmaking algorithms for Web services range from algorithms based on the DAML-S Service Profile to improved ones based on the DAML-S Service Model. In this paper we propose a new technique for Web service discovery which features a flexible matchmaking by exploiting DAML-S ontologies. Our algorithm allows for partially matched services to be discovered by addressing issues such as: (1) fine-grained matchmaking at the level of atomic processes rather than at the entire service level as in previous approaches, (2) multiple runs of services, and (3) the fact that non-trivial requests can only be satisfied collectively by a set of services rather than by a single execution of a single service. In this way we extend the matchmaking process between queries and advertisements from one-to-one to one-to-many.

1. INTRODUCTION

SOC [12] is a computing paradigm which uses services as building blocks for developing applications. Basically, services should be technology neutral, loosely coupled components and should support location transparency so as to be optimally exposed by providers and easily discovered by requesters (clients). Such services vary from simple ones such as returning the postal code given a town, to complex ones such as selling airline tickets/shopping portals. SOC relies on the Service Oriented Architecture (SOA) for creating such an infrastructure in which services are published, discovered and executed with minimal programming effort. The basic SOA implies providers which expose services to a service registry and requesters which discover these services and execute them, both through the use of service descriptions. A service description minimally contains information about the functionalities provided by the service but it can further be augmented with behavioural information as in e.g. [1, 4, 6, 10] as well as other type of information such as Quality of Service (QoS), preconditions, effects and so on. The World Wide Web Consortium (W3C) as well as other standards bodies strongly support a Web service model having three component roles – users, providers and registries – in which providers advertise their services to the registries, from where users further discover such services. The Universal Description Discovery and Integration (UDDI) is currently the only universally accepted standard for Web service discovery and it consists of a specification for defining a service registry of available Web services similarly to a global electronic yellow pages. As noted by [5], "currently Web services are simple and static" and standards for Web services that can be dynamically discovered and composed are still to follow. Moreover, complex Web services based interactions between businesses require more than SOAP, WSDL and UDDI can offer, hence future Web services standards will have to cope through others with Web Services Description Languages (that should extend WSDL with behavioural elements such as QoS, preconditions and effects), Choreography, Orchestration as well as workflow, negotiation and management standards.

(Web) service discovery is the first major problem to be tackled and it is often referred to as (Web) service matchmaking. Matchmaking is the process that takes as input a query specifying the inputs and outputs (IOs) of a desired service as well as a service registry consisting of (service) advertisements and that gives as output a list of matched